(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 April 2002 (04.04.2002)

PCT

(10) International Publication Number
WO 02/27132 A1

(51) International Patent Classification[7]: E05F 15/00

(21) International Application Number: PCT/US01/42384

(22) International Filing Date:
28 September 2001 (28.09.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/236,457 29 September 2000 (29.09.2000) US

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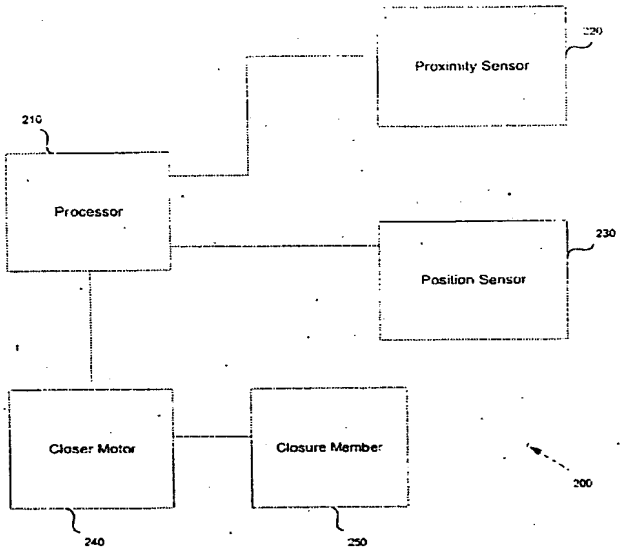
(81) Designated States *(national)*: DE, GB, JP.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: POWER CLOSURE SENSOR SYSTEM AND METHOD



(57) Abstract: A power closure sensor system is disclosed. The system includes a data processing device, a closer motor in communication with the data processing device and controlling the movement of a closable member, and a proximity sensor, configured to sense the location of an object. The proximity sensor is in communication with the data processing device. The proximity sensor is configured to communicate the location of the object with or without the object contacting either the closable member or the frame. The system also includes a position sensor configured to sense the position of the closable member. The position sensor is in communication with the data processing device. Further, the system includes a logic program running on the data processing device and the logic program is configured to generate an estimate of the location of the object relative to the closable member.

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POWER CLOSURE SENSOR SYSTEM AND METHOD

REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 60/236,457, filed on September 29, 2000, the entirety of which is herein incorporated by reference.

BACKGROUND

[0002] With the advent of powered closure systems, such as, but not limited to automotive windows, it would be desirable to provide a sensor system in which an object, such as but not limited to a person's hand which is in the closing path of the closable member, such as the window, is able to sense the object within the path of travel of the window and reverse direction of or halt the closing of the window. Reversing the direction would thereby prevent the hand or other object from being caught or pinched by the moving window against the window frame.

[0003] Current systems detect an object either after an object has been trapped and the motor stalls, or the position of the closure member does not change. In such systems the required force may be set too low so that it will reverse without an actual object in the opening. This could be caused by ice build up on the perimeter seal or other frictional forces that cannot be predicted by the system. Other systems may work on current or speed sensing and therefore have problems similar to the problems listed above. The majority of systems currently available actually pinch an object before reversing and in many cases could cause discomfort to a person or cause damage to an object.

[0004] Accordingly, there is a need for a system that senses an object before the actual point of contact. Further, there is a need for a system that will not trap an object prior to reversing the closer motor, instead the closer motor will reverse when it detects an object within a sensitivity range.

[0005] It would be desirable to provide a system and/or method that provides one or more of these or other advantageous features. Other features and advantages will be made apparent from the present specification. The teachings disclosed extend to those embodiments which fall within the scope of the appended claims, regardless of whether they accomplish one or more of the aforementioned needs.

SUMMARY

[0006] An exemplary embodiment relates to a power closure sensor system. The power closure sensor system includes a data processing device and a closer motor in communication with the data processing device. The closer motor controls the movement of a closable member relative to a frame. The power closure sensor system also includes a proximity sensor configured to sense the location of an object. The proximity sensor is in communication with the data processing device and the proximity sensor is configured to sense the object location when the object does or does not contact the closable member or the frame member directly. Further, the power closure sensor system includes a position sensor. The position sensor is configured to sense the position of the closable member. The position sensor is in communication with the data processing device. Further still, the power closure sensor system includes a logic program running on the data processing device. The logic program is configured to generate an estimate of the location of the object relative to the closable member.

[0007] Another exemplary embodiment relates to a method of preventing a powered closable member from closing, the closable member supported by a frame. The method includes determining the location of an object using a proximity sensor, the object not being required to have direct contact with at least one of the closable member and the frame. The method includes determining the position of the closable member, and computing the location of the closable member relative to the object. The method also includes determining that the object is within a predetermined range relative to the

8. A method of preventing a powered closable member from closing, the closable member supported by a frame comprising:

determining the location of an object using a proximity sensor, the object not being required to have direct contact with at least one of the closable member and the frame;

determining the position of the closable member;

computing the location of the closable member relative to the object;

determining that the object is within a predetermined range relative to the closable member;

stopping a closing motor from advancing the closable member.

9. The method of claim 8, wherein the closable member is a vehicle window.

10. The method of claim 8, wherein the closable member is a vehicle door.

11. The method of claim 8, wherein the proximity sensor is a capacitive sensor.

12. The method of claim 8, wherein the proximity sensor is an infrared sensor.

13. The method of claim 8, wherein the logic program includes a neural network.

14. The method of claim 8, wherein the logic program includes a fuzzy logic program.

15. A power closure sensor system for a vehicle, comprising:

a data processing device;

a closer motor in communication with the data processing device and controlling the movement of a closable member on the vehicle relative to a frame for the closable member;

a capacitive sensor, configured to sense the location of an object, the capacitive sensor in communication with the data processing device, the capacitive sensor enabled to sense the relative location of the object when the object does or does not touch the closable member or the frame;

a position sensor, configured to sense the position of the closable member, the position sensor in communication with the data processing device; and

a logic program running on the data processing device and configured to generate an estimate of the location of the object relative to the closable member.

16. The power closure sensor system of claim 15, wherein the closable member is a vehicle window.

17. The power closure sensor system of claim 15, wherein the closable member is a vehicle door.

18. The power closure sensor system of claim 15, wherein the logic program includes a neural network.

19. The power closure sensor system of claim 15, wherein the logic program includes a fuzzy logic program.

20. The power closure sensor system of claim 15, wherein the estimate of the location of the object is compared with a sensitivity range to determine whether closing of the closable member should be terminated.

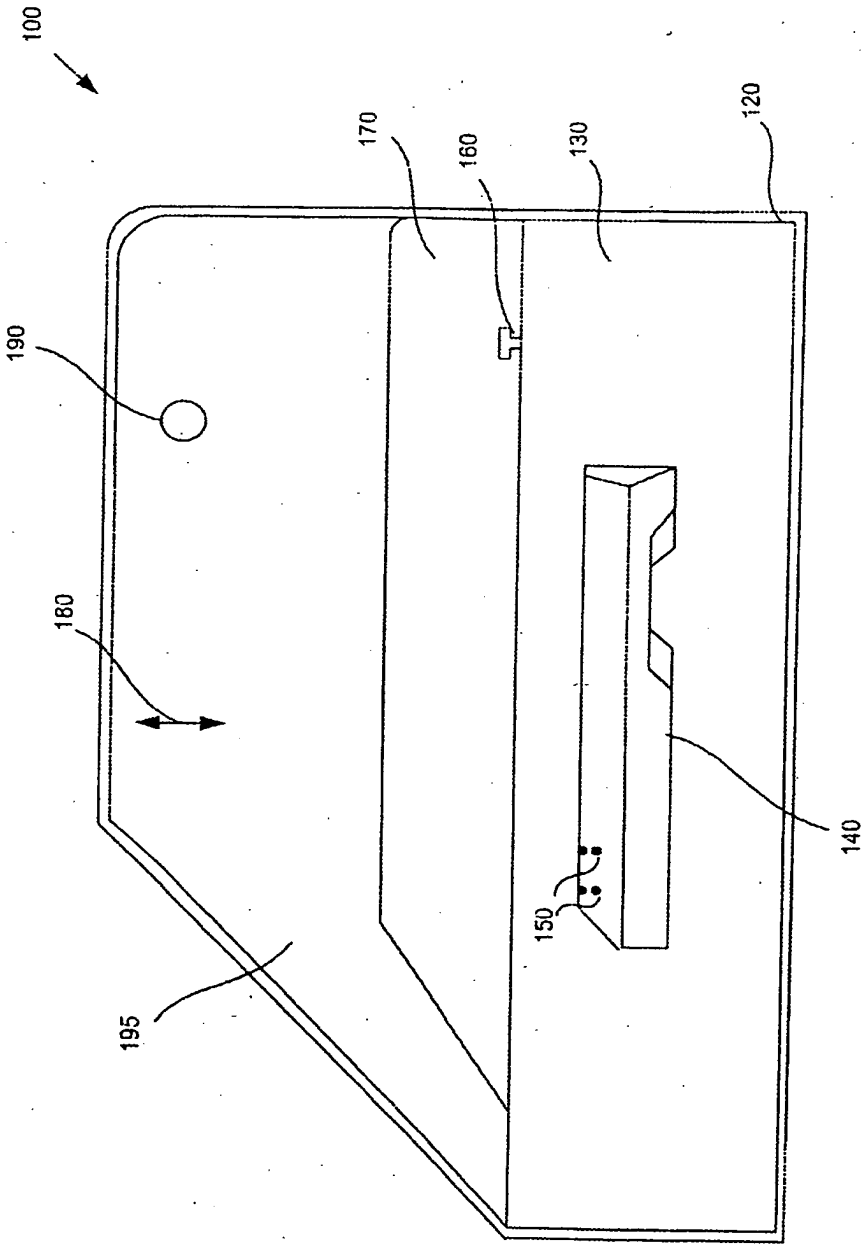

FIG. 1

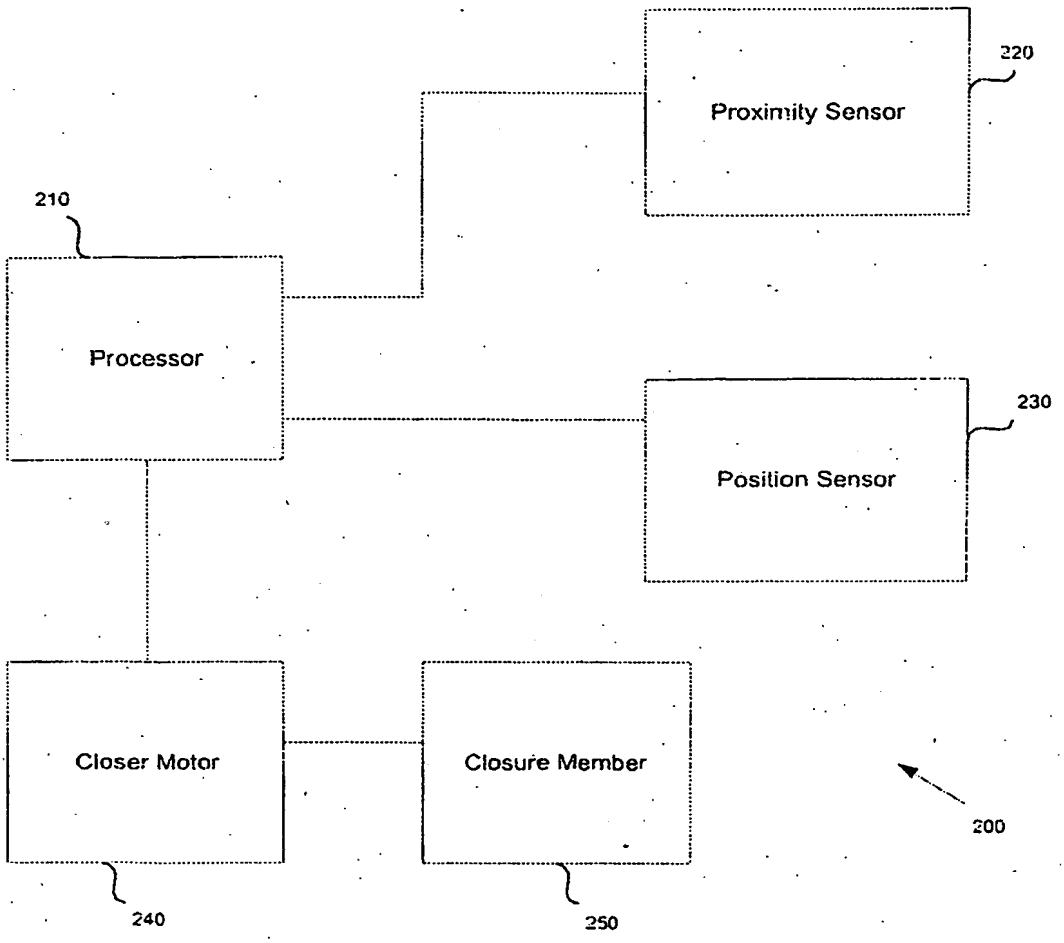

FIG. 2

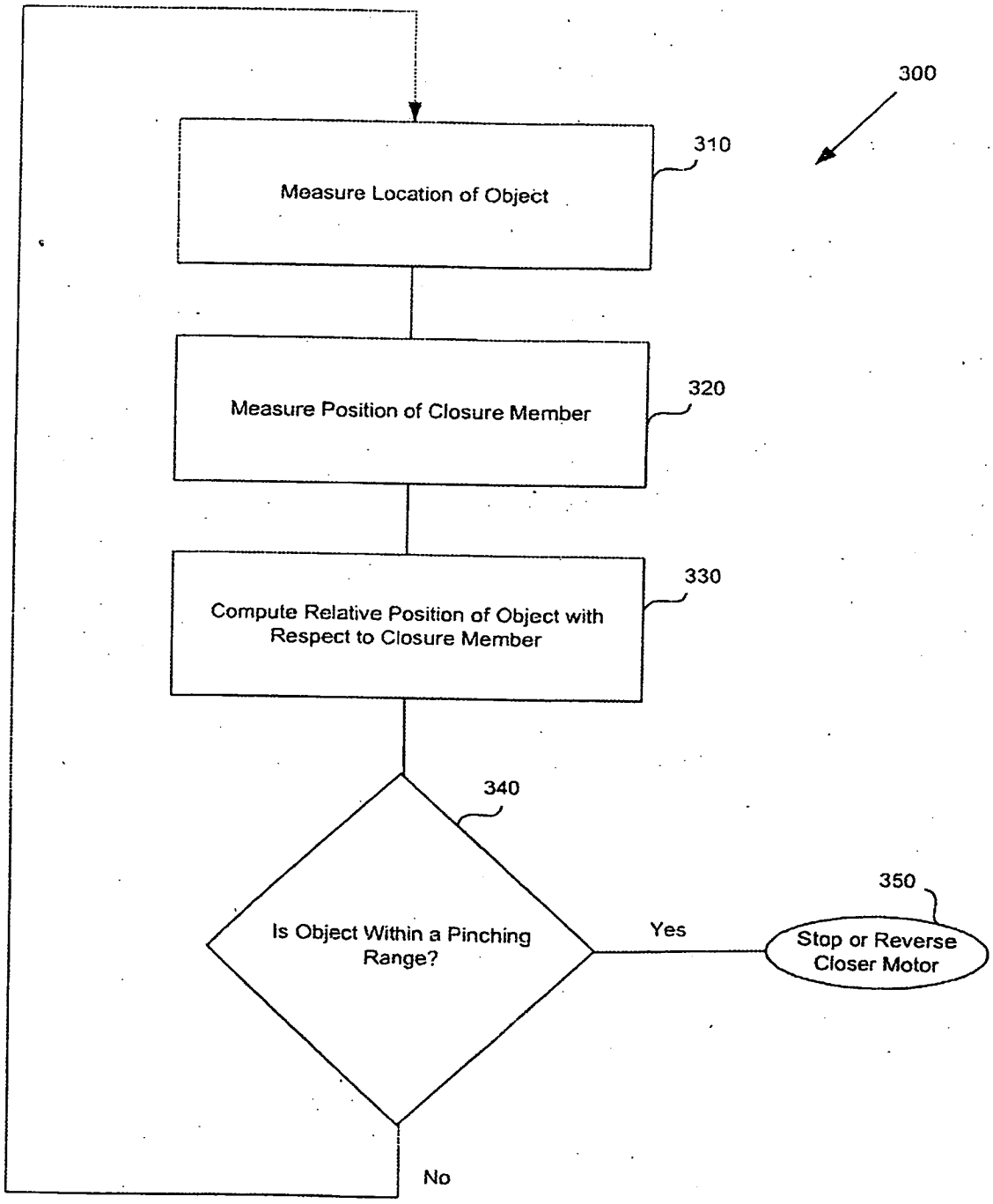

FIG. 3

INTERNATIONAL SEARCH REPORT

Inte pplication No
PC /US 01/42384

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E05F15/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E05F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 40 04 353 A (BROSE FAHRZEUGTEILE) 14 August 1991 (1991-08-14)	1,2,4,5, 8,9,11, 12,15, 16,20
Y	column 2, line 12 - line 25	3,6,7, 10,13, 14,17-19
	column 5, line 4 - line 40 column 5, line 57 -column 6, line 8; figure 1	
Y	GB 2 289 332 A (AUTOMOTIVE TECH INT) 15 November 1995 (1995-11-15)	3,6,7, 10,13, 14,17-19
	page 42, paragraph 3 -page 43, paragraph 2; figures 16,17	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 February 2002	13/02/2002

Name and mailing address of the ISA	Authorized officer
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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int pplication No
PC /US 01/42384

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4004353 A	14-08-1991	DE 4004353 A1	14-08-1991
GB 2289332 A	15-11-1995	GB 2324864 A ,B	04-11-1998
		US 6039139 A	21-03-2000
		US 6116639 A	12-09-2000
		US 5901978 A	11-05-1999
		US 6141432 A	31-10-2000
		US 5629681 A	13-05-1997
		US 5835613 A	10-11-1998
		US 5822707 A	13-10-1998
		US 5748473 A	05-05-1998
		US 5845000 A	01-12-1998
		US 5829782 A	03-11-1998
		US 2001015547 A1	23-08-2001
		US 2001029416 A1	11-10-2001
		US 2001038698 A1	08-11-2001